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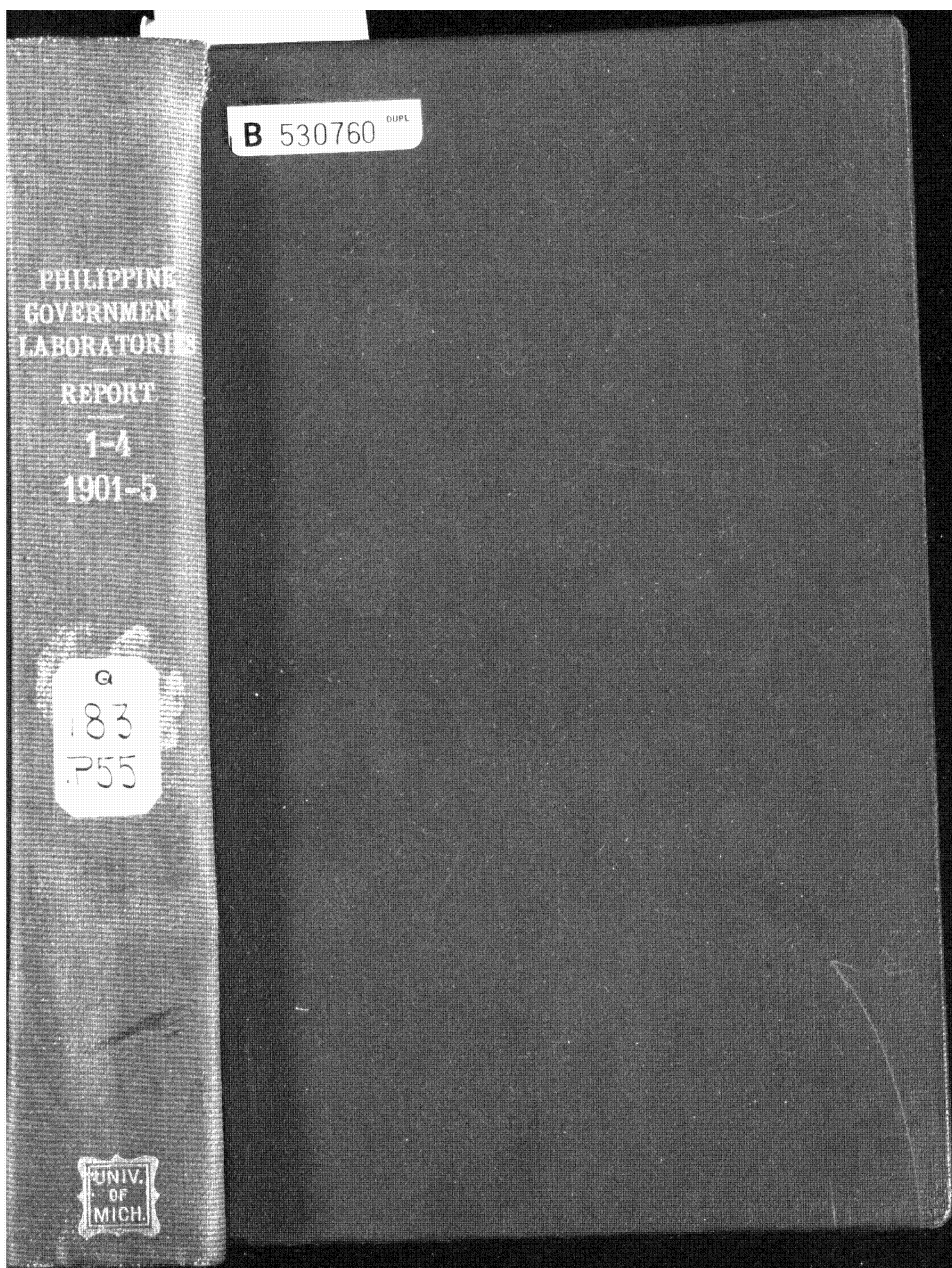
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FOURTH ANNUAL REPORT  
OF  
THE SUPERINTENDENT OF THE  
BUREAU OF GOVERNMENT  
LABORATORIES

FOR THE  
YEAR ENDING AUGUST 31, 1905

TO THE HONORABLE  
THE SECRETARY OF THE INTERIOR

BY  
PAUL C. FREER  
SUPERINTENDENT OF GOVERNMENT LABORATORIES

MANILA  
BUREAU OF PRINTING  
1906



## FOURTH ANNUAL REPORT OF THE SUPERINTENDENT OF GOVERNMENT LABORATORIES.

DEPARTMENT OF THE INTERIOR,  
BUREAU OF GOVERNMENT LABORATORIES,

*Manila, September 15, 1905.*

SIR: The Bureau of Government Laboratories has been established in its present buildings since September, 1904, and power was used for the first time at the formal opening of the Laboratories on February 28. Therefore the machinery has been in operation approximately for six months and it is possible very nearly to calculate the cost of operating the plant and to determine whether an economy has been effected by installing the machinery. The result of comparative tests, both with an even and with a varying load, shows that the power we have used on an average has cost about 10 centavos per kilowatt hour, the outlay for the engine-room force and for wear of the engines not being included therein. It would be difficult to estimate what increased charges should be added for the latter purpose, because, were the Bureau to use any other source of power, it would need machinery to do its work, and such machinery would be subject to wear and tear and would require an engine-room force as well as the present plant. However, it would seem a safe estimate to say that any other source of power would need to be furnished at less than 15 centavos per kilowatt hour if it were to compete with the present machinery. The cost of the building and its accessories has been as follows:

|   | United States<br>currency. |
|---|----------------------------|
| Main building and power house.....                                    | \$121,099.55               |
| Mechanical equipment, laboratory desks, hoods, fixtures,<br>etc ..... | 68,475.06                  |
| Stables and small animal houses.....                                  | 11,022.08                  |
| Grading and filling .....   | 912.30                     |
| Total .....   | 201,508.99                 |

When we consider that for this sum the Government has obtained a large building, with boilers, engines, dynamos, piping, laboratory desks, hoods, fixtures, vaccine, and horse stables, it is evident that, considering the expense of materials in this country, we have a plant the cost of which will compare most favorably with that of any similar one in other countries. When we recall the many branches of scientific work

taken care of by this one institution and compare the cost of the buildings with that even of the simpler university laboratories which are generally devoted to one subject only, it will be evident that the Government of the Philippine Islands has by no means been extravagant in its outlay for scientific work. The cost of the permanent apparatus and the library was approximately as follows:

|                 | United States<br>currency. |
|-----------------|----------------------------|
| Library .....   | \$36,000                   |
| Apparatus ..... | 26,000                     |
| Total .....     | 62,000                     |

This gives a grand total of \$263,508.99. The request for appropriation for all expenses of the Bureau of Government Laboratories for the fiscal year 1906 is \$154,943.06, United States currency, which is 2.05 per cent of the total appropriation for all Departments of the Insular Government for the fiscal year 1905. When we consider the results which can be obtained by a thoroughly equipped laboratory and the many ways in which this institution already has aided the Government, this charge is certainly a moderate one. Valuable information in many fields has been acquired, given, and published, the public health has been conserved by means of accurate diagnoses of disease, and the serums and prophylactics in daily use have been prepared. The educational value of a scientific bureau and the possession and use of a scientific library can not be underestimated.

From the beginning it has been the intention of the Government to have the Laboratories organized so as to take their part in the economic development of the Islands, but while there can be no question, even in the lay minds unaccustomed to scientific problems, of the utility in an economic way of the biological, chemical, and serum laboratories, there have, from time to time, been doubts expressed as to the legitimate functions of botanical and entomological work. To make clear the relationship of the botanist to this field of work, it must be remembered that all botanical investigations at the present time are primarily dependent on systematic botany and that this branch of the science can not study its material without having at its disposal properly prepared and preserved botanical specimens collected and filed in an herbarium. The latter should be so arranged as to be readily accessible and the material collected should, where possible, have reference to the relative abundance or scarcity of the individual species, their distribution, and native names and uses. The herbarium thus becomes a card catalogue of the economic and scientific aspects of Philippine botany. With such material at hand, it is possible to identify all plants of economic value and to determine their occurrence in countries other than the Philippines, where at present they may have uses unknown to us. Frequent requests

for identifications and for statements as to the value of plants are received from the American and European residents of Manila and of the provinces, and much information has been furnished as to the occurrence and abundance of plants which may be economically useful. The information so asked can often be supplied from the data compiled in the herbarium, and the necessity of importing seeds or living plants can thus be avoided. To determine the identity of a Philippine plant with the same individual of a surrounding country, it is essential to ascertain the correct scientific name of the species, because the native name is of no value in this respect. To cite an instance, it became possible for this Bureau to show that Philippine narra is identical with Indian *padouk*, a timber which has long been favorably known in the European markets and where it commands a high price, and it is evident that we can ship narra under its Indian name and thus command a market where otherwise delay would result and importers would need to be convinced of the uses of our wood.

The forest trees of the Philippines are now known to exceed 1,500 distinct kinds. The manner of growth in marked forest areas, the conditions essential to the best development of the trees, and the means to be adopted to further forest interests are largely dependent upon botanical work. In agriculture, the identification of economic species of wild and cultivated food and fiber plants, of fruits, and so forth, have been of great value, and the correlation of the data so obtained with similar facts developed in regard to other countries has given us knowledge which can be made the basis of economic results. A study of the parasitic fungi which attack and destroy rice and other crops, fruit, cacao and similar trees is of course one of great importance. This involves not only the identification of the host but also that of the parasite, so that we may apply methods which have been used by investigators in combating the same or similar diseases in other countries.

The teaching of botany has been undertaken by the Bureau of Education, both in the Normal School and the provincial high schools, and to render this work feasible and more than perfunctory, extensive herbaria for distribution to the provincial high schools have been prepared. In the economic work of the Bureau of Government Laboratories, the identification of plants producing oils, resins, rubber, gutta-percha, alkaloids, and so forth, has been an essential preliminary to the prosecution of investigations on economic products.

The entomologist has been consulted by private and commercial tobacco growers and manufacturers; by cocoanut farmers, rice, cacao, and coffee growers; by chocolate manufactures; the street railways; the Bureau of Forestry on the method of preventing insects from destroying timber; by the Bureau of Agriculture in regard to the growing of rice, garden vegetables, corn, cotton, cocoanuts, jute, and cacao; by the Army and



Navy in reference to the pathological importance of flies, because of their possible pathogenic and pathoforic forms; and by the Laboratories for identifications of insects connected with various diseases. The relation of ticks to Texas fever, of flies to surra, and other similar problems all come before the entomologist for consideration.

In order to establish identifications and to compare the results with those obtained in other countries it is as necessary to have an entomological collection as it is a botanical herbarium. In addition, the entomologists have been able to attack economic problems, such as the production of silk in the Philippine Islands, the best method of rearing the worms, and the means to be adopted for producing a breed which may possibly be resistant to Philippine conditions and which will be able to live on ordinary Philippine leaves.

In considering the outlay necessary for the Bureau, it should be taken into consideration that its equipment is to a large extent purchased and that this outlay involved the investment of a certain amount of capital. The running expenses of the Bureau would approximately be as great as they are now, even though the corps of workers were to be reduced, whereas it is evident that additions to the present corps will cost the Government but little beyond the salaries of the individuals so added, while the good which can be accomplished is disproportionately greater. It is very unfortunate that the laboratory force is at present not sufficiently large to enable the Bureau to keep men continuously on one specific problem when once its study has been begun. The present conditions render it imperatively necessary to take men from investigation on which they are engaged and to transfer them to the routine work brought to the Bureau from other divisions of the Government. The expectation of complete results on any one economic line will be much increased if the Laboratories were allowed even a very few men who could devote their time continuously to problems of this nature, because interruption not only means actual time lost by taking the worker away from his investigations but it also means loss of time by taking down and setting up of apparatus, by the decomposition of products which should be worked up immediately, by the change of interest of the worker to a new field and by the difficulty of again readjusting himself to the subject at exactly the point where it was left. Consequently, it is evident that the loss of time is not merely the loss in hours during which the employee's energies are engaged in other directions, but there is also a not measurable delay due to the above causes. Therefore, it is advisedly said that one employee giving his time continuously to one economic problem can accomplish more than three could by giving equal amounts of partial time. It is to be hoped that at a not too distant date the Government will feel itself in a position, to a certain extent, to increase the number of workers in the Bureau.

During the Superintendent's recent visit to the United States he discovered that the increase in the manufacturing interests, not only in chemical but in biological lines, has been so great that positions in the various manufacturing houses were now available at good salaries, even to undergraduates. With this fact before us, it is evident that if we wish to procure thoroughly trained men the scale of salaries in this Bureau must ultimately be increased. A poorly trained man or one not capable of accurate results is worse than useless, for his reports may cause incalculable damage. It is literally true in an institution such as the Bureau of Government Laboratories that the salary of a cheap man is eventually the dearest outlay which could be made.

During the past year, between the months of October, 1904, and June, 1905, the Superintendent of Government Laboratories was in the United States on leave. Dr. R. P. Strong was Acting Superintendent during this period and it was while he was so acting that the final work in completing the building was done. The last details therefore fell upon Dr. Strong in seeing that the plans were completely carried out, and the thanks of the Superintendent are due to him for the painstaking and conscientious manner in which he met the responsibilities imposed upon him.

The Superintendent of Government Laboratories, while in the United States, visited a number of educational institutions. The University of California, Leland Stanford University, the University of Wisconsin, the University of Chicago, and Columbia University are included in this list, and in each place he endeavored to ascertain what well-trained young men were available for Philippine service. One difficulty he encountered at the outset, namely, the great reluctance of scientific men who had family connections to come to the Philippine Islands at the salaries which we could offer, but during the visit a number of young men were discovered who might be secured. All of these are properly trained, possess degrees from well-known institutions of learning, and to judge from personal observation are well fitted for our work. It would seem advisable, where universities can furnish us with the names of candidates for our positions, and where these candidates have the backing and guaranty of qualified teachers who are masters in their respective lines of work, to omit a competitive examination such as is generally required by the Civil Service Board. It is well to consider the arguments on the other side, namely, that by announcing competitive examinations the Civil Service Board is able to secure candidates from a wider range of territory and is able to give everyone in the United States who cares to compete an opportunity of so doing and also to subject all to a rigid scrutiny, unbiased by the recommendations given by teachers to pupils. However, in practice the result is not as satisfactory as might be expected from the premises. An examination can frequently be passed very satisfactorily by a man who is but ill equipped to take part in the practical,

everyday work of a laboratory, and such examination gives no indication whatsoever of the ability of the candidate in respect to original work. It has been the writer's experience during his university career that not infrequently students who during the course of the college year had shown themselves deficient in many respects, were by reason of concentrated study in the last few weeks able to outclass many of their companions in the examinations, when in reality these companions were far superior in the quality of their work and the results which they were able to obtain. The same must necessarily be true in examining candidates by civil-service methods for scientific positions in these Laboratories. On the other hand, where the men can personally be interviewed, and, more especially, where their teachers can be met, the Bureau can obtain a much greater certainty as to their availability for the class of work to be undertaken. Perfunctory examinations might lead us to expect candidates highly proficient in the technique of their respective lines of work, whereas actual demonstration might prove their knowledge to be largely theoretical and acquired from text-books; besides which, workers in the laboratories must be familiar with the literature of their subjects and able to use the journals intelligently and with definite ends in view. The argument might be advanced that were this system of competitive examinations not followed, the candidate from the smaller college would not be considered. However, it must borne in mind that thoroughly trained scientific men of to-day, if they have taken their preliminary undergraduate course in one of our smaller colleges, must certainly have fitted themselves for their future positions in one of the universities. It is evident that many of our smaller institutions can not have at hand facilities, apparatus, and literature with which thoroughly to train their advanced students. Indeed, one of the troubles with the class of students which they graduate is that they can not realize their shortcomings, never having come in contact with broader standards to compare themselves with. Another difficulty which presents itself in selecting candidates by competitive examination is found in the fact that many of the best men, who are in a position to obtain situations in our universities or in our large manufacturing establishments which control scientific laboratories, do not care to take their time, or to place themselves in competition in the manner prescribed by the present *modus operandi*. As a result, and I believe experience bears this out, the competitive scientific examinations very often altogether miss the best material. It is believed that the proper means of filling laboratory positions is to be found in a personal investigation of the merits of the various candidates by members of the laboratory staff or, where this is not possible, by the recommendation of professional men of the highest standing at home. This opinion is written with the full knowledge that some very good men on our present staff have been secured by this

method of examination. The list of men available can not be maintained indefinitely. A year after a member of the laboratory force has visited universities in America, most of the scientific workers whom he will have encountered will have obtained permanent and lucrative positions at home, so that the list of available names is a constantly changing one. The same criticism holds good of the competitive examinations, where a few months after such an examination is held it is frequently found that the best men who have taken it are no longer willing to come. This condition must inevitably be true where a limited number of vacancies exist and where it is generally impossible to predict at what time a position will be open. It frequently happens that a member of the staff leaves for America without allowing the Bureau the time for finding his successor by competitive examination, because this method necessarily takes a number of weeks after the notice of the vacancy has reached America. For this reason it would seem advisable, in filling laboratory positions, to adopt the policy of placing on the list of available candidates such men as have been discovered by competent members of the laboratory force while on leave in the United States, and in addition to select from recommendations of the best authorities at home, candidates who know of our work, who are interested in it, and who will be available in a much shorter time than the ones selected by any other method. It would be easy to name men of high standing in all branches of science who would gladly and conscientiously further our interests in this respect and, if they knew that the Civil Service Board would apply to them, they would be careful to bear in mind the necessities of our service and to train students for it, and instructors would notify us of available men. It is believed that by this means we would always have a satisfactory number of candidates and in addition would avoid useless delays. The latter question is one of great importance because when a vacancy under the present system occurs it is not infrequently a question of months before it can be filled, and as a consequence the strain upon the laboratory force and continued change of work on the part of its individual members is always serious during these intervals.

Besides interviewing the presidents and members of the faculties of the universities mentioned above, the Superintendent made some inquiries as to the feasibility of securing donations for the laboratories for specific equipment and for fellowships. Primarily, this institution labors under the difficulty encountered by all State organizations in the unwillingness of persons of means to give funds where, in their opinion, the support should devolve upon the State, and although great interest is manifested in our work, yet actual gifts have been few. However, encouragement was held out in regard to a donation to establish a marine biological laboratory, and the necessary data as to the expense of such a division have in large part been collected. The plan proposed would

include a laboratory in Manila with an exhibition room for the general public and private rooms for the workers, a scow or flatboat for migratory service, equipped with a dwelling cabin, laboratory, pumps, and aquaria, a steam launch to move this laboratory from place to place, and the usual equipment of scientific apparatus. A considerable proportion of the expense would of course fall upon the library. Much of the literature on the subject of marine biology is to be found in journals devoted to the purpose and which would need to be purchased outright. However, a certain quantity of this, especially that part concerning fish and fisheries, is to be found in Government publications, and steps have already been taken to secure such literature free of cost or by exchange with the publications of this Bureau.

The plan of work for a marine biological laboratory would consist in gathering materials by means of the migratory station, in mapping out areas, and in studying the habits of the marine fauna of the Islands, and in sending to Manila such portions of the work as would need to be developed in a permanent station. The investigation of the fish and fisheries from an economic standpoint is, because of our situation, the most important phase of the matter. By the help of a suitable laboratory, an examination of the fisheries could be made and a study of the habits and food of the fishes undertaken, and when this is at least in part completed, measures for the protection of the various species could be inaugurated. Search for new fishing grounds, particularly of trawling areas, would also fall within the scope of the work, and in this way territory at present unavailable would be made economically useful. At present, fishing in the Philippine Islands is of a desultory character, being carried on by the natives and by Japanese in small boats and over limited areas, yet in many of the regions where such fishing is practicable the food fishes are rapidly becoming depleted. Trawlers would be particularly useful in developing the occurrence of flat fish, such as soles, plaice, turbot, brill, and others which dwell upon smooth and sandy bottoms and which can only be captured by modern methods. It would also be in the interests of the Islands to determine the best means of protecting, rearing, and regulating the capture of the green and tortoise-shell turtles, to encourage the culture of pearl oysters, lobsters, crabs, and shrimps. It is also true that sponges apparently of a high quality have at times, in a desultory way, been observed in the Philippine Islands, and it would seem probable that large areas exist which it would be profitable to develop. A marine biological laboratory would also desire to work on the purely scientific phases of the question, which, of necessity, go hand in hand with the commercial ones.

The estimate of the cost of this undertaking has not entirely been completed because several features of the construction of the aquaria and of the laboratory are still under discussion. It might be assumed that

the cost of the Manila central aquarium would be about \$30,000, United States currency, that of the portable scow \$4,000, of the launch \$8,000, and of the apparatus and equipment, including laboratory tables, row-boats, trawls, seines, dredges, microscopes, glassware, etc., about \$4,500. In addition to this equipment, maintenance, repairs, and employees would cost about \$20,000 a year more. This expenditure would place the undertaking on a secure footing and would undoubtedly bring the best of results, both in a commercial and in a scientific way. The Superintendent of Government Laboratories will forward all the estimates in regard to this matter to the United States as soon as the accurate data are completed, and it is hoped a sufficient interest will be aroused to bring the matter to a successful issue. Much of the information which has been gathered has been with the assistance of Professors Reighard and Duerden, of Ann Arbor, Michigan, whom I wish to take this opportunity of thanking for the great interest they have displayed.

The Superintendent, in addition to the obtaining of data on the marine biological laboratory, also discussed the subject of scholarships or fellowships during his visit to the United States. It is hoped that some of our institutions in the United States will, in the future, send men to these Islands for the purposes of studying tropical conditions.

Another phase of laboratory work was brought to the attention of persons interested in Philippine resources, namely, the question of the establishment of field parties to investigate the medicinal plants of the Islands and to bring into the laboratories supplies necessary for chemical work on this subject. There is unquestionably a large amount of material for profitable research of this kind, but the laboratories have been unable to do anything in this direction owing to lack of employees; work on the medicinal plants not only involves exploratory operations in the field but also investigations in the central institution. It was impossible to do both these things at once, because when a man was spared from the laboratories for exploration in the provinces, the necessary work of the Bureau was neglected. This question was brought before some of our leading manufacturing chemists and the possibility of some concerted action discussed. Whether it will bring results in the future can not be stated. Certainly no one is more interested in this question than our manufacturing chemists, who are constantly securing new products or improving the quality of the old. Were they able, by means of such explorations, to enlarge their pharmacopœia or to obtain from reliable sources substances now commonly used, the results would certainly be to their great advantage.

Throughout the United States, in scientific circles and in the various universities, the greatest interest in the laboratory work was manifested and many flattering comments were received. The educational value of the institution was especially dwelt upon and many expressed the

belief that the advancement of the Philippine people could best be undertaken by means of scientific work carried on by the best investigators obtainable and by means of the best equipment possible. In Europe, especially in Germany, the Superintendent found all university men with whom he came in contact conversant with the work and willing to assist in every way. Some of the leading professors of the University of Berlin were especially interested in the plan of the Bureau to provide space and laboratory facilities for scientific guests and a number expressed the intention of availing themselves of the hospitality of the Bureau within the next year or eighteen months.

We are now on a satisfactory basis as regards the exchange of materials; botanical, ornithological, and entomological specimens are identified by investigators both at home and in Europe and our publications are freely exchanged. In this way a knowledge of the work of the Bureau is spreading, and our men to a certain extent keep in touch with outside scientific investigators. However, this is not all which is needed. Not only should we be able to exchange the inanimate objects of the laboratory or the written results, we should also be able to do the same with the laboratory force so that suitable persons in America would, for a time, visit Manila to take the place of our own men engaged in studies similar to their own. This exchange might be for a year at a time or more properly for eighteen months. Our laboratory workers would be benefited by renewed contact with the scientific world and the interests of the institution would be advanced by having each year within its walls men who had recently come from the scientific centers of the world. Unquestionably this would exert the greatest influence in maintaining the Laboratories in a condition of constant rejuvenation. It can not be denied that scientific workers are isolated in Manila, that the contact with other men in their own lines, so necessary for the most successful results and for the exchange of ideas, is denied them, and unless the Bureau is gradually to become stagnant it must have this infusion of new ideas and experiences. It is strongly recommended that some exchange arrangement be authorized by the Commission. The Superintendent of Government Laboratories has already discussed the matter with prominent university men at home and in each instance met with their hearty approval. The greatest difficulty to present itself would be that it would not always be possible to exchange men of exactly the same qualifications and of relatively the same salaries.

The question of establishing a medical school in the Philippine Islands has been under discussion ever since the formation of the Board of Health. It has always been recognized that medical instruction which would include laboratory work and which would be open to Filipinos with the proper preliminary training is an essential for the carrying on of efficient hygienic work in the Islands. However, the time of the

founding of such a school has always been postponed because facilities for placing it upon a dignified and permanent basis were not available. This is no longer the case. With the equipment of the Bureau of Government Laboratories and the class rooms and supplies of the Bureau of Education, the beginning of medical instruction with small classes need no longer be delayed. During the absence of the Superintendent of Government Laboratories, the feasibility of some definite recommendation to the Commission was discussed by Drs. McDill, Heiser, Strong, Musgrave, and Newberne, as well as by a number of others, and as a result a committee empowered to propose a feasible plan for beginning the work was appointed to confer with Commissioners Worcester and Tavera. Definite action was delayed until the return of the Superintendent of Government Laboratories, and then Dr. Barrows, of the Bureau of Education was also called into consultation, and a concrete proposal was made. Dr. Barrows has established a preliminary course leading to medical instruction in the Bureau of Education, the curriculum of which seems to be admirably adapted to fitting students for the first years of medical instruction. The number of men who will be prepared to go on with the work at the beginning will be limited, perhaps not more than five or six will be fitted during this year, so that work in chemistry, histology, bacteriology, and physiology can be conducted in the laboratories of the Normal School and of this Bureau, whereas the anatomical laboratory instruction can be given in the San Lazaro morgue belonging to the Board of Health. The latter place is not by any means ideal, both from the standpoint of location and facilities; nevertheless, it will for the present serve the purpose, until a building near to the laboratories and equipped with refrigerating space can be built.

The greater part of the equipment, in the form of glassware, and other appliances is on hand, and but little excepting instruments for the courses in physiology and pharmacology need be purchased. The Commissioner of Public Health and employees of his Bureau, the force of the Bureau of Government Laboratories, the teachers of science in the Bureau of Education, and certain among the practicing physicians in Manila can very well handle the courses of instruction for two or three years. Ultimately, the school will need a building for its purposes. Modern instruction in medicine for the greater part consists in laboratory work, the former custom of teaching by means didactic lectures having been abandoned, so that in its structural features this building would mainly be devoted to laboratory purposes. As a union of interests is always economical, the structure should be placed in proximity to the present Laboratories. The Government hospital when it is established and the various private institutions will furnish the necessary clinical amphitheaters.



The establishment of such a school by the Government and not by private individuals will from the start insure it freedom from the necessity of support by fees, a necessity which is so often detrimental to private educational institutions. It can and must maintain a high standard. Its very existence will, it is hoped, bring to the Islands a number of physicians, eminent in the various specialties, who would take places on the faculty and on the hospital staff. To insure a high standing it would seem evident that not only the educational control but also the nomination to the controlling board for membership on the faculty should be in the hands of the members of the latter body, and great care in filling the various chairs should be exercised. Young men with growing reputations or those who have yet to secure a place in the literature of the scientific world can well afford to begin their connection with the institution as clinical associates or assistant professors, having the hope of full professorships held before them as the reward for work well done and for published research of a standard character. Because the school would in the beginning be small and because its present teaching force would need to be filled by men on the ground who know each other intimately and are aware of each others shortcomings, should be no reason why the positions on the faculty should be underrated or why we should not place the standard so high that no one should feel himself entitled to a full professorship who could not with reason believe that he would be recognized for a corresponding position in our best schools at home.

In the original plans of the Bureau of Government Laboratories, space was provided for the class of work then coming under the jurisdiction of the institution. This building was so calculated that each of the individual rooms could take up a further number of workers on similar subjects, so that expansion in the lines originally proposed was possible for at least fifteen years to come. After the structure was well under way, additions to the staff in the form of the botanists and the ornithologists and their collections were very wisely made, as their work properly belonged to the Bureau. This class of work now occupies four rooms of the building leaving only two laboratory rooms for scientific guests. The herbarium is a bulky collection and is constantly increasing. It is evident that the time must come when these collections will exceed any space which can be given to them, unless it be in a museum or in some structure with large rooms especially devoted to such purposes. It is for this reason that attention is called to the fact that in the original plan of the structure there were contemplated two wings, to accommodate the Bureaus of Mines, Ethnology, Public Lands, Agriculture, Forestry, the botanical herbarium, and the collections which have been added to the Bureau of Government Laboratories by transfers from the others. It doubtless is true at the present time that the Bureaus of Forestry and Agriculture, owing to the increased space obtained by the purchase of

the old Oriente Hotel, now have ample room, so that possibly two wings no longer are necessary, unless it is deemed desirable to place a commercial and general museum in one of them. However, a smaller wing at much less cost, having the general architectural features of the original plan and designed to accommodate the Bureaus of Mines and Ethnology, the working botanical, mineral, ornithological, and pathological collections is urged upon the Commission for serious consideration.

During the past year the union of all the scientific libraries of the Government in the Bureau of Government Laboratories has been accomplished. By transfer from the various Bureaus the library has obtained 6,799 volumes, and although this consolidation involves a net saving to the Government, the charge upon the appropriations for this Bureau for subscriptions and the current scientific journals has been largely increased, so that it now annually amounts to \$1,750, United States currency. According to the original understanding with the Commission, the library of the Bureau was to receive a sum of \$45,290.66 in quarterly, semi-annual, or annual installments. One of these amounting to \$7,715.11 is still due to the Bureau, and owing to the union of all scientific libraries this fund will need to be expended differently than it has been in the past because it now must cover all branches of science, so that the Laboratories will actually receive less than was originally intended. However, a certain proportion of the funds allowed to the library on each appropriation bill have not been expended for two reasons, one because the Superintendent of Government Laboratories wished to leave a margin of safety between the estimated and the actual cost of books, and the other because a number of sets which it was desired to purchase could not be obtained of the dealers. These funds, having lapsed, are no longer available for the purchase of books but, after the present final installment to be appropriated for the Laboratories has been expended, and when accurate data are available showing what books on the list sent to dealers can not be obtained, the librarian will draw a balance sheet showing what proportion of the moneys originally authorized have not been paid out, and the Commission will then be asked to reappropriate this sum for the uses of the library. It is evident that, with the increased requirements brought about by the consolidation, further funds will be necessary in the future, but by the method proposed it seems evident that, in all probability, the needs for a year or a year and a half to come can be covered. During the past year there have been published by the Bureau and mailed by the library 20,425 bulletins. An effort has been made to exchange our publications for those of foreign publishers, societies, or associations, so as to diminish the cost of subscriptions as far as possible. While in many instances our request for exchanges have been complied with, in others it has been found impossible to obtain subscriptions on this basis, one reason being that the publications of the Bureau appear in the form of bulletins and not as

a journal. Therefore, from a financial standpoint it would seem advisable to send out the work of the Bureau as a scientific journal which should have the usual characteristics of publications of this class. The standard, as has been the case in the bulletins, should be of the highest and the recognition which such a journal would receive, coming as it does from one of the chief scientific institutions of the Tropics, would be immediate. The cost would not very much exceed that of the bulletins and it is certain that a journal would not only receive more attention from our co-workers, but it would also be given more general reviews in the various publications of the world. By this means the Bureau could demand exchanges and our list of subscriptions paid for could be reduced to a minimum. Probably also with exchanges bringing the journal before the world by means of reviews, it would be possible and feasible to charge an annual subscription to all other persons or societies who might desire the publications for themselves. The greatest objection would be the variety of work which would find a place in its pages, so that specialists, who cared only for particular things, would find articles in which they are interested appearing only at certain intervals, and therefore a large amount of material would be sent to them which would be valueless, but this difficulty could be met by issuing reprints of papers which would go only to persons who would be especially benefited by them, whereas the additional cost would be met by a subscription price.

#### **BIOLOGICAL LABORATORY.**

During the past year continued attention was given to the development of the pathological museum, many specimens of great value being added to it. The collection is now mounted so as to be of the greatest possible use both to the laboratory force and to the physicians of the city. The specimens obtained at autopsy are immediately prepared by Mr. Will-young, and the appearance of the museum reflects great credit both on him and on the Director of the Biological Laboratory, whose interest in the collection has been a constant one. For some of the specimens we are indebted to Drs. Brinckerhoff and Tyzzer, who came here to take up certain phases of the work on variola begun by Dr. Councilman, of Harvard University. Dr. Tyzzer left Manila on December 15 and Dr. Brinckerhoff a few months later, returning to America via the Suez Canal. Both of these gentlemen made the best use of their time while in the laboratories and the results of their work will be published after they have been thoroughly studied in America. The thanks of the Bureau are due to Drs. Brinckerhoff and Tyzzer for the interest which they displayed in the various branches of our work.

Dr. William B. Wherry resigned this position as bacteriologist, after completing the publication of four papers of undoubted merit. Dr. Wherry was succeeded by Dr. Ralph T. Edwards.

During the year Dr. Strong, Director of the Biological Laboratory, has continued work on his cholera vaccine and of late has found an opportunity to put it to a practical test by inoculating a large number of the inmates of Bilibid Prison during the recent outbreak of cholera in that institution. The inoculations have all resulted practically without local irritation and with but a slight, though pronounced, general reaction. The prisoners treated were not inconvenienced. A study of the blood immunity obtained in these persons will be made. Cholera has disappeared from the confines of Bilibid and consequently Dr. Strong is not in a position to state by actual evidence that intestinal immunity is conferred by reason of the immunity in the blood, but in any event a study of so many human inoculations will be a most valuable criterion as to the value of the vaccine in times of epidemic. Theoretically, it would seem not only reasonable but almost certain that blood immunity, if we consider the histological and physiological relations of the blood to the lining walls of the intestine, would also confer immunity to the inoculated individual from infection *per oram*.

Dr. Musgrave left for the United States on leave of absence on May 23, after completing a further amount of work on the pathology of intestinal amœbiasis in conjunction with Dr. Woolley. In addition, Dr. Musgrave has taken the opportunity of attending the Portland meeting of the American Medical Association and presenting a review of the work which he has done on the question of amœbic dysentery. This review excited general interest and directed the attention of physicians in America to the work of the Laboratories even to a greater degree than has heretofore been the case.

Dr. J. B. Thomas, attending physician and surgeon of the Civil Sanitarium at Baguio, Benguet, also worked in the Laboratories during several months and published a paper on the action of various chemical substances on cultures of amœbæ. This paper had especial reference to the destruction of amœbæ by a number of well-known chemical substances in solution, the object being to determine the exact value of local disinfectants.

During the year the Laboratory has been enabled to render a considerable assistance to physicians of the Army and of the Navy, both by reason of the medical library and by consultation.

Work on the cholera vaccine and on amœbæ is being continued. For the purpose of following out the physiological chemistry of the latter organism a large Vaughan incubator, capable of cultivating large quantities of organisms at one time, has been ordered. In addition to the above, Dr. Edwards has devoted some time to the culture of the fungi and bacteria which grow upon fresh coconut meat and upon copra for the purpose of demonstrating the organisms which cause rancidity. The

results will be published in a bulletin on the subject which is now in the process of preparation.

As is the case in other divisions, the routine work in the Biological Laboratory takes precedence over everything else and as a consequence it not infrequently happens that research work needs to be abandoned in favor of the other, more pressing, necessities. In a biological laboratory this is at times especially unfortunate because much of the material used in investigations is of such a perishable nature that the loss in time by allowing such materials to stand is much greater than the actual hours devoted to routine work. It is to be hoped that when funds are available this condition in the Biological Laboratory can be remedied, because, while routine diagnoses of existing diseases are necessary for the guarding of the public and individual health, nevertheless, advances in new methods of studying, diagnosing, and treating diseases can only be made after research work of the most painstaking character. The improvement brought about in the treatment of amœbic dysentery and the preparation of a new cholera vaccine should demonstrate how much greater the final results of research are than those of work in any other direction.

#### CHEMICAL LABORATORY.

The Chemical Laboratory, more than the others, was handicapped in the old building by lack of proper facilities, because chemical work can at the present time only be carried on by means of modern appliances and apparatus. The results of the change to the present quarters are already noticed in the research work which is being accomplished. Dr. Clover has undertaken a study of gums and resins and has already differentiated a number of chemical substances in the wood oils and in the Manila elemi. The portion on wood oils is in condition for publication; the work on elemi is much more difficult. The terpenes contained therein in large quantities are extremely interesting and worthy of study, but it is only by such study that a proper commercial use for elemi can be discovered and the value of the product, which could be obtained in large quantities in the Philippine Islands, enhanced.

During the absence of the Superintendent of Government Laboratories Dr. Clover was Acting Director of the Chemical Laboratory, and in this capacity took charge of the routine work as well as of his own investigations. At the present time he continues in immediate direction of the details of the analyses brought into the laboratory, the actual work being carried out by the various members of the force.

Mr. Walker, as has been mentioned above, has found time to continue and practically to complete his work on copra and coconut oil, with the exception of the changes which take place in the germinating nut. This work will be published in conjunction with that of others on *Cocos*

*nucifera*, and when published will form a résumé of all the practical points discovered in this laboratory and will be of use as a guide to planters and oil makers.

Mr. Richmond has begun an investigation of the fiber plants to be considered in the paper-making industry. Apparatus for this work has been purchased or manufactured in Manila, and the results so far have been extremely encouraging. A number of common grasses, such as the two varieties of cogon, certain fiber wastes like those of abacá and maguey, some palm stems and tree trunks have already been investigated.

Mr. Fox has devoted himself entirely to assays and to mineral analyses. It must be realized that a mineral analysis, when accurately performed, is one of the most tedious and time-taking operations which can come to a chemist. Good mineral analysts it might be said "are born, not made." Many chemists, however talented, never acquire the patience or manipulative skill to obtain accurate results in this direction. Therefore it is evident that if we wish in any degree to cover the field of mineral analyses in the Philippine Islands as it should be done, and if we wish to acquire the information in regard to our mineral resources which is absolutely necessary to their development, more mineral analysts will be needed. One man can not accomplish more than a certain amount. Hurried work is worse than useless, and careful, painstaking, and accurate results can with the present force only be brought out in limited quantities. We have in the Islands limestones, coals, gold-bearing and other ores, and countless other rocks and minerals the analysis of which would, in addition to assisting the operation of the Mining Bureau, be of incalculable value in giving us an understanding of the actual conditions which surround us. One question has frequently been brought to the attention of the Chief of the Mining Bureau and also to that of the Laboratories. This is the one as to whether certain ores submitted can be worked by the cyanide process and what the results in gold value of such a process would be. It is scarcely possible to give entirely satisfactory answers where laboratory methods alone are used, and therefore it would seem not only to be profitable but also expedient to place in the laboratories a small stamp mill and cyanide plant, so that miners could bring their ores to the laboratory and have demonstrated to them by practical results just what could be expected. Such model plants are made and are purchasable in the United States, and it is hoped that sufficient funds will be available to undertake this class of work. The question of the gas values and coking properties of our coals is also one which needs consideration, and therefore the installation of some small coal-gas retorts and a gasometer for experimental purposes would be extremely advisable. The cyanide plant and the gas retorts obviously could not be placed in the laboratory building but should be installed in

a shed of rough materials, or possibly space could be provided for them in one of the wings which were originally contemplated.

The subject of weights and measures was taken up by Dr. Gilbert N. Lewis, the physical chemist in charge of this Division of Weights and Measures. He made a careful study of the conditions in the Islands and embodied his results in a report which was made to the Honorable the Secretary of the Interior. At the same time, Dr. Lewis suggested a law which was designed to correct the existing evils, and to change all of the weights and measures in the Islands to the metric system within the next eight or ten years. In the meanwhile, some of the local weights and measures which exist will be retained, with the proviso that they are reduced to a reasonable equivalent in the metric system. Through the United States Ambassador at Paris, certain standard weights and measures, to serve as the chief normals of the Islands, have been ordered, and a number of sets of less accuracy, but still entirely adapted to the purpose, have been bought by the Insular Purchasing Agent for distribution to the provincial governments. A distinction must be drawn between weights and measures and their standardization and the weighing and measuring as it is carried on in the Philippine Islands. According to the recommendations of Dr. Lewis, the first portion of the work—that is, the standardization—can be done in the Laboratories, but the second portion, that of regulating, weighing, and measuring in the Islands, had best be transferred to a Bureau which has agents in many localities, and the Bureau which most naturally suggests itself for this purpose is that of the Internal Revenue. It would seem feasible to regulate and adjust weighing and measuring and the weights and measures in use in the provinces by means of internal-revenue officers and to collect the charges for this work by internal-revenue stamps, as is the case with the products subject to tax under the Internal Revenue Law. The actual work of physical chemistry in the laboratories has been somewhat limited, Dr. Lewis having devoted a great deal of time to work just mentioned. I regret to state that Dr. Lewis will soon leave for the United States, and in choosing his successor I believe it will be feasible to obtain a man who is not only thoroughly conversant with weighing and measuring and with the principles of physical chemistry in sufficient degree to carry out the work necessary in that line, but who is also interested and who would devote himself to mineral analysis in the form of its most modern development and who would be able to do research work in inorganic chemistry.

Mr. Charles L. Bliss, physiological chemist, resigned on August 14, 1905, after three years of service in the Islands. His work always was of the most painstaking and accurate character. His successor has not yet been selected in the United States.

**SERUM LABORATORY.**

During the year the work of the Serum Laboratory has continued according to the plan adopted in the past. The appearance in epidemic form of more or less severity of rinderpest in various parts of the Islands has brought upon the Laboratories a great demand for the serum. During a portion of the year, after the shipment of Government cattle from Shanghai ceased, it was very difficult to obtain animals for virulent blood, our former arrangement having been that with each shipment of Shanghai cattle a certain number of virulent-blood animals were sent to the Laboratories. As a consequence, during the months of May and June of this year the production of rinderpest serum fell off to such an extent that the demands of the Board of Health could not be met and veterinarians were sent into the provinces with an insufficient supply. This trouble has of late been obviated by bringing to Manila cattle from the Island of Sibuyan, where rinderpest has never appeared. These animals have all proven to be highly susceptible and the supply of blood, so long as they can be obtained, will be sufficient to meet the needs of the future. The serum animals have been transferred from the Insular Purchasing Agent on memorandum receipt, the Laboratories returning them to the Bureau to which they belong when they are no longer useful for the preparation of serum. The number of animals still left on Burias Islands, the place where the Government cattle were sent, is now about seventy, so that this supply will probably suffice for nine months or a year. After this time the question of obtaining serum animals will once more become serious. The Laboratories for the past year have not used the original method of simultaneous inoculation. Instead, they have given serum to the animals upon receipt at the laboratory and a few days later have given virulent blood. The results have been better as regards mortality than they were when blood and serum were given at the same time. During the year no animals were lost in the laboratory as a result of inoculation against rinderpest. This work has been carried on by Dr. Sorrell, and the uniformly good results are due to his energy and painstaking care. His responsibilities involve not only the care of over one hundred cattle and a varying number of calves, but also the executive control of about twenty laborers and foremen, personal attention to inoculations and bleedings, and veterinary services in guarding the health of the animals in the institution. Economy in operation, so as to cut down the cost of production, is constantly in the minds of the employees. Several variations in the feed rations have been tried during the past year and at present analyses are being made in the Chemical Laboratory to determine the cheapest and best theoretical food which can be given to the cattle. One trouble in the serum laboratory at San Lazaro has been found in the recurrence, at times, of foot-and-mouth disease. Whenever this happens a great amount of extra work



in the treatment, isolation, and care of the animals is involved. The disease is so prevalent in Manila that it has been found impossible entirely to exclude it from the grounds. A complication of foot-and-mouth disease with rinderpest is practically fatal in all cases, whereas foot-and-mouth disease alone can be cured with more or less readiness.

Since the beginning of the cholera outbreak in Manila, Dr. Ruediger has practically devoted his entire time to the preparation of cholera vaccine. This is an extremely painstaking and difficult operation. Slight variation in the technique may result in the complete loss of a large amount of material and time, besides which work carried on day by day without change is of a very monotonous character. It is greatly to the credit of Dr. Ruediger that he has taken hold of this difficult problem and carried it on in a successful manner, so as to produce an efficient and satisfactory prophylactic.

#### THE ENGINEERING FORCE.

The mechanical plant of the Bureau has been in charge of Mr. William P. Williams, who was transferred to this Bureau from the Bureau of Architecture, he having been present throughout at the construction of the building and at the installation of its power plant, and therefore is familiar with every detail of the installation and of the piping within the building. The engines throughout the year have been alternated, one unit only being used at a time, and thus ample opportunity for minor repairs has been given. The coal consumption has been kept at a minimum and whenever practicable the engines have been shut off at the close of the working hours of the laboratory. However, occasions arise, such as the testing of the refrigerating plant or at times when important work would be destroyed by an interruption, when the machinery has been continued for a longer period. The average run per day is about nine hours and the amount of coal consumed approximately one ton. The gas machine has operated satisfactorily without any breakdown whatsoever and with the melting out of only one retort, so that the average life of a gas retort under present conditions is approximately one year, while in the old laboratory from five to six months was all that could be counted on. The difference is due to the care with which gas making can be carried on under the direction of an experienced engineer. At no time during the year has the laboratory work been interrupted through the lack of gas. In a building of this kind, with several hundred valves, stopcocks, and many hundred feet of piping, with refrigerating machinery and electrical machinery of all kinds, minor repairs, if the plant is to be kept in a proper condition, must constantly be made. The same is true of the laboratory apparatus. Much of it has been in use for several years and repairs and alterations are therefore becoming necessary. Another factor of importance is the gradual substitution for water

baths and other appliances heated by gas of an arrangement by which steam heat alone will be utilized on this class of apparatus. The saving is obvious. Gas costs us considerably more than steam and every change by which the use of the former can be eliminated is so much gained. These alterations to enable steam heating to be applied to much of the original apparatus involves work on the part of the engineering force. In addition to the above, many appliances have been constructed on the premises, although a great deal of work has needed to be given out. From the above brief account of the duties which fall upon the engineer and his staff it is evident that an economy would be effected by providing another assistant. It was at first thought that an instrument maker, who would devote his time to nothing but apparatus, would be absolutely essential to the Bureau, but it is probable that, for a year at least, the needs can be met by engaging a native workman of experience, solely to be employed on the work of repairs and alterations under the direction of the engineer. Obviously, at the present time the engine-room force has for its main purpose the care of the engines, boilers, and plant, and work on the piping system, alterations for the use of steam in place of gas, and the making of appliances and instruments necessary for specific work have to be done at odd moments or to be given to outside manufacturers. By this means great delays result, and in many instances delay means loss in money. It is evident then that from a business standpoint the allowing of this assistant to the engineer is most essential, besides which it is obviously a waste of money to have a man on the salary of \$1,800 a year doing work which can be accomplished by an employee at \$30 a month.

#### CONCLUSION.

The year has been marked by a steady growth in the work of the Laboratory and in the results accomplished. Gradually, our institution is becoming known throughout the world and the high standard of its publications is being recognized. We have in the Bureau of Laboratories an institution which not only fills the needs of the community in answering questions of a scientific nature which demand an immediate answer, but which is also endeavoring to advance our knowledge of the conditions which surround us and to discover means to improve them. It should be an organization in which everyone should take an interest and a pride, as its very existence typifies the trend of modern thought. It should be regarded in the same light in the Philippine Islands as it is among the educated classes at home, and every effort should be made to keep its dignity and its standing unimpaired. This can best be accomplished by maintaining a high standard among its employees. As all of the scientific workers are university graduates and men who have been accustomed to good surroundings at home, it is often a disappointment

to them, on reaching Manila, to learn that work of a scientific character has not the regard of the community at large which it really should have. With the continued support of the Government, it is hoped that in time these conditions will be altered and funds will be available for the payment of better salaries and for placing the employees upon a better footing. It is only by continual growth that an institution can avoid stagnation. Standing still in reality means retrogression, and our constant endeavor should be to have each year show a distinct and marked advance over the preceding ones.

I am, very respectfully,

PAUL C. FREER,

*Superintendent of Government Laboratories.*

The SECRETARY OF THE INTERIOR, *Manila, P. I.*



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FOURTH ANNUAL REPORT

OF

THE SUPERINTENDENT OF THE  
BUREAU OF GOVERNMENT  
LABORATORIES

FOR THE

YEAR ENDING AUGUST 31, 1905

TO THE HONORABLE  
THE SECRETARY OF THE INTERIOR

BY

PAUL C. FREER

SUPERINTENDENT OF GOVERNMENT LABORATORIES

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